Broadband Forum overview and new developments in the Broadband industry

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Broadband Forum
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Agenda

- Broadband Market
- Who we are and how we work
- What we are doing and why
- Wrap up

Global Headlines

- Broadband - more than 445 million customers
- IPTV - 26.9 million Telco subscribers
- Asia accounts for 39% of all broadband customers and 31% of all IPTV
  - 171 M broadband customers now in region
  - China strong broadband lead on all other countries
  - 54% IPTV growth in one year to reach 2.9 M
- Europe accounts for 30% of all broadband and 51% of all IPTV
  - 135 M broadband customers now in region
  - 29% broadband growth in one year for Eastern Europe
  - 50% IPTV growth in one year to reach 13.6 M
- Americas account for 28% of all broadband and 19% of all IPTV
  - 125 M broadband customers now in region
  - 86% IPTV growth in one year to reach 5 M milestone

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Countries in the top 10

Broadband Top 10					
	2008Q2	2009Q1	2009Q2	Growth	Growth
Country	Total	Total	Total	in Quarter	over 12 months
China	75,768,350	89,888,000	93,549,000	4.07%	23.47%
USA	**74,440,195**	**83,974,547**	**86,227,582**	**2.68%**	**15.83%**
Japan	29,584,700	30,666,900	31,085,500	1.36%	5.07%
Germany	21,420,702	23,729,350	24,086,250	1.50%	12.44%
France	16,601,286	18,009,500	18,324,300	1.75%	10.38%
UK	16,718,400	17,661,100	17,838,200	1.00%	6.70%
South Korea	15,061,659	15,706,466	15,876,992	1.09%	5.41%
Italy	11,534,230	12,595,533	12,855,463	2.06%	11.45%
Brazil	8,490,400	10,065,200	10,469,755	4.02%	23.31%
Canada	9,005,181	9,527,500	9,618,107	0.95%	6.81%
Spain	8,594,776	9,062,767	9,166,427	1.14%	6.65%

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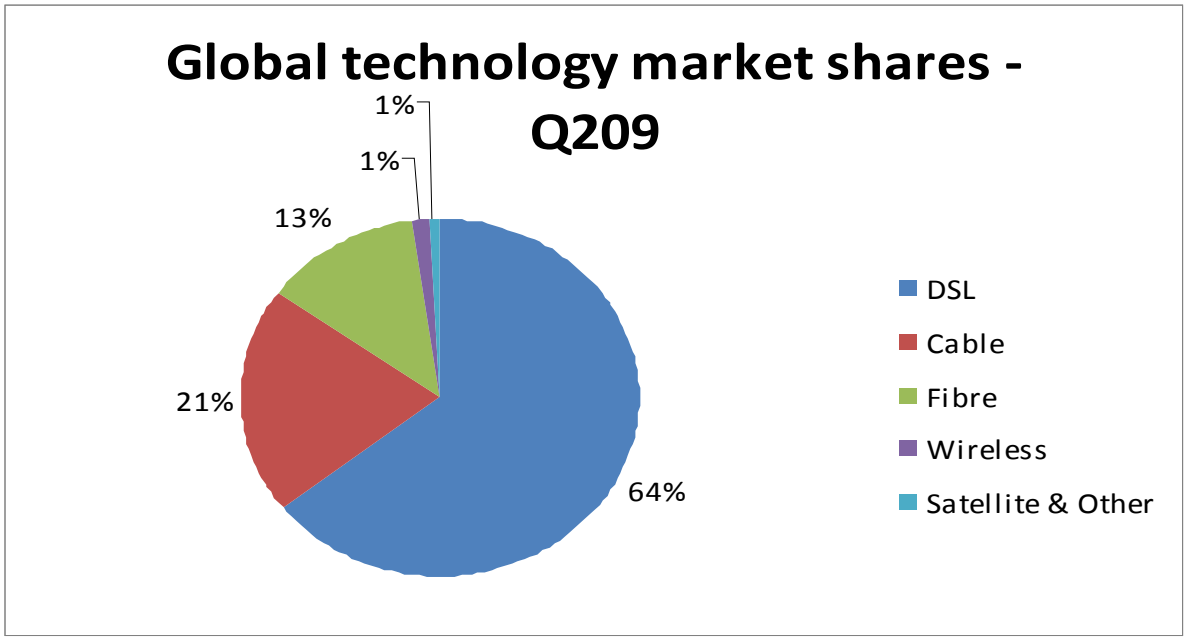
Access Technology Breakdown

Fiber (5% growth) & Wireless (8% growth) on uptake



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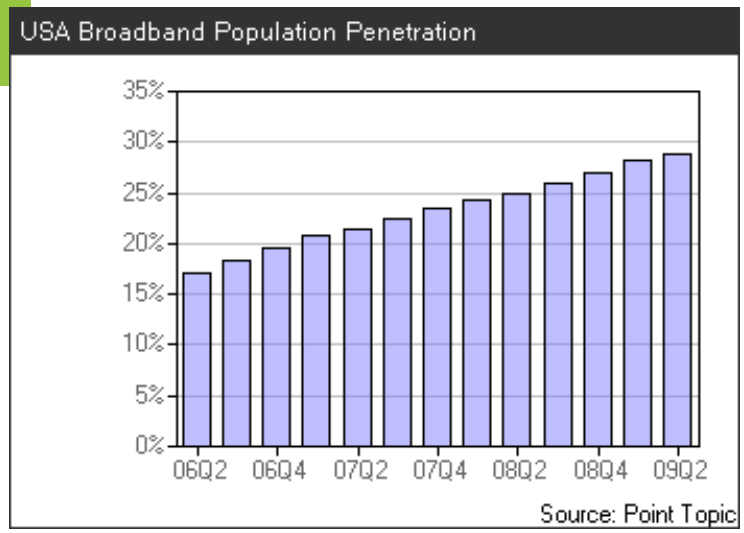
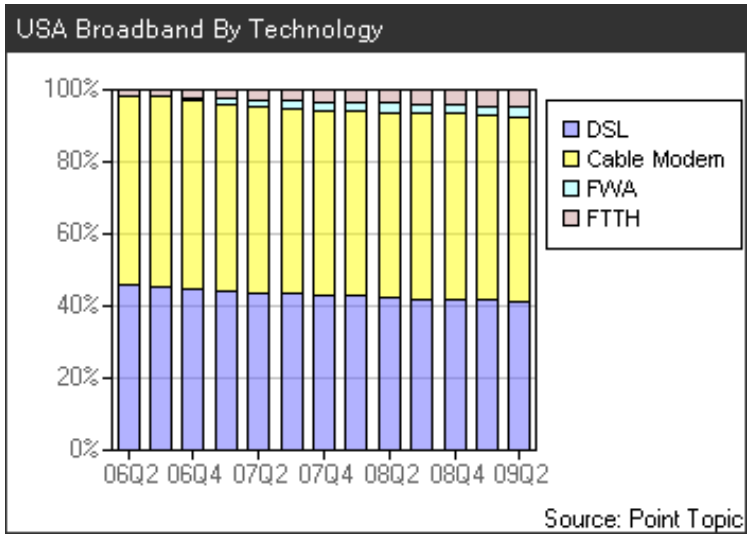
USA Broadband Snapshot





- Steady and continuous growth
- Hybrid fiber/copper networks help Telcos
  - Reach
  - Speed
  - Stable platform for a greater number of services

Who we are and how we work

Becoming The Broadband Forum

- The Broadband Forum mission is to develop the full potential of broadband by defining how to deploy interoperable BB technologies
- Focused on home-to-core network based solutions, our standards empower providers to achieve more with their broadband deployments
- Membership
  - Service Providers: Incumbent Telcos, CLECs, ISPs,
  - Vendors: Systems, chip-sets, test equipment, management software …
  - Others: Consultants, Test labs, universities, regulators
  - Global membership - every region represented

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How We Work

- Board sets strategic direction
- Service Providers shape & prioritize work
  - Service Provider Action Council meets at every meeting
- Members meet face-to-face four times a year
- Working Groups have interim meetings
  - For some groups these are weekly
  - Decision making generally by consensus
  - Usually via teleconferences, occasionally face-to-face e.g. IPv6 mtgs, NG-PON workshop, OMA-DM workshop
- Member companies write “contributions” which drive work forward
- Our solutions are packaged as **BroadbandSuite** releases
- Releases made up of Technical Reports (TRs) and Marketing Reports (MRs) focusing on a theme
- We actively liaise our work to other standards bodies
- We also organize interoperability test events and sometimes tradeshows/demonstrations

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Active Broadband Forum Technical Liaisons & Cooperation

Improve information sharing, cooperation, avoid duplicate or overlapping requirement developments in the global SDO ecosystem

- 3GPP
- Alliance for Telecommunications industry Solutions (ATIS)
- Broadband Services Forum
- Consumer Electronics Assoc. (CEA)
- Digital Living Network Alliance (DLNA)
- European Telecommunications Standards Institute (ETSI)
- Femto Forum
- Home Gateway Initiative (HGI)
- Home Grid Forum
- Internet Engineering Task Force (IETF)
- International Telecommunication Union (ITU-T)
- Metro Ethernet Forum (MEF)
- MultiService Forum (MSF)
- Open Mobile Alliance (OMA)
- Open IPTV Forum
- Telemanagement Forum (TMF)
- Universal Plug and Play Forum (UPnP)
- WiMax Forum

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BBF “Themes” and the wider Broadband industry

- BBF, the ITU-T and the PSOs
- Architecture, best practice, generic broadband management and interoperability
- Technology agnostic
- Contribution driven work
- Focusing on real world problems and opportunities
- Many specifications are consistently quoted in RFPs
- Effective liaisons keep the industry coordinated (avoid duplicate efforts and contradictory requirements) and progressing

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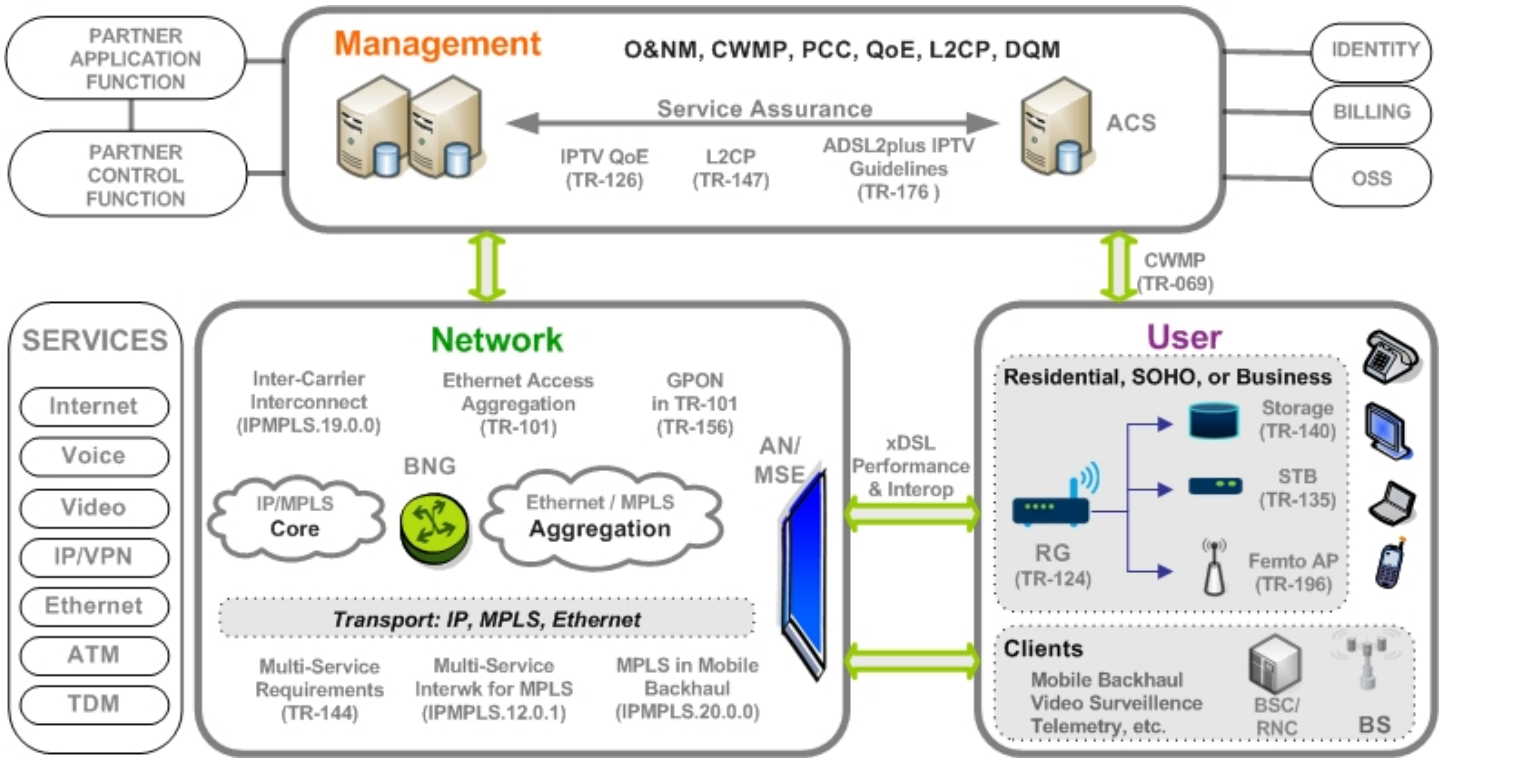
BBF “Themes” Applied to Broadband Spec developments

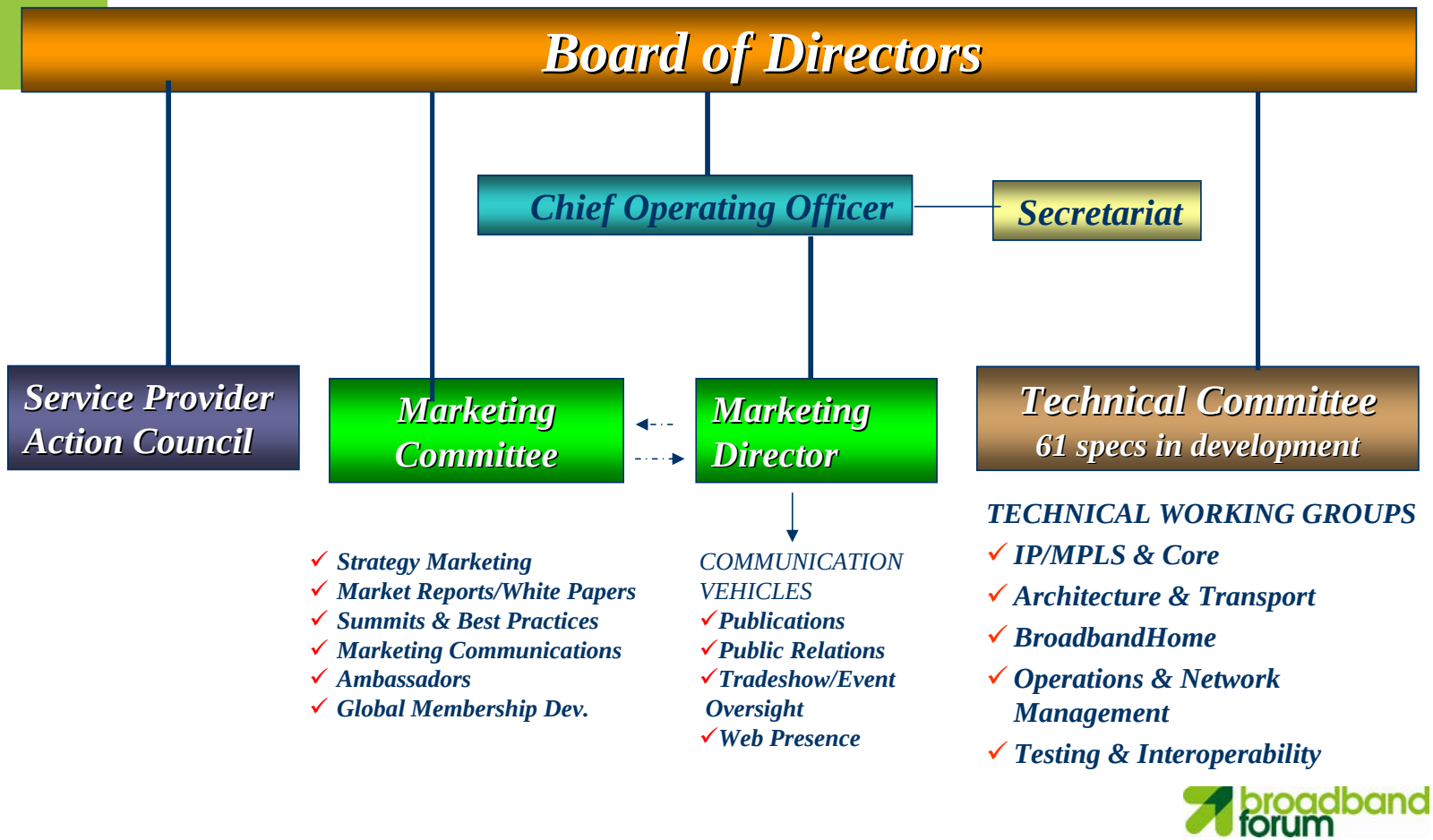
IPTV
Policy Control
Energy Efficiency
IPv6
Home Networking
Evolving CPE Management
Improving Content Delivery
Convergence
PHY Test & Interoperability

(Currently 61 specs in development)

Broadband Forum Scope



Broadband Forum Organization



Test and Interoperability Working Group

Currently Focused on Improved ADSL2/2+ and VDSL2 Performance & Interoperability, new work on Energy Efficiency and G.hn

Test & Interoperability WG – industry issues

- Levels the playing field regarding capabilities and features
- At chipset level, reduces risk for systems vendor
- At system or network element level, reduces risk for Service Providers (SPs)
- Competition reduces cost
- Increases Service Provider and User choice
- Manufactures selected by SP in initial deployments generally lock up product procurements for years. Manufactures want standards as way of breaking the lock on initial vendor selections.
- Eases deployment if solutions comply with standards, and are interoperable
- Increase deployment of VDSL2 / ADSL2+
- G.hn and GPON?

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Test & Interoperability WG

- TR-100 issue 2 : ADSL2/2plus (G.992.3/5) Performance Test Plan - changing pass/fail requirements, addition of defined noise environment for Annex M EU-64 mask
- WT-105 : G.992.3/5 (ADSL2/ADSL2plus) Functionality Test Plan
- WT-114 : VDSL2 Performance Test Plan
- WT-115 : VDSL2 Functionality Test Plan adding new tests (INP, LCL, SRA, G.ploam configuration parameters, dual latency, wide band bit-swap)

  Note: Bonding, erasure, retransmission and vectoring currently not included in Test & Interop specs
- WT-138 : Validation of G.997.1 Parameters
- PD-139 : Interoperability Test Plan for VDSL2 Plugfest – ongoing
- WT-202 : Guidelines for the use of existing ADSL2/2plus L2 (low power) parameters and minimize becoming a disturber

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Test & Interoperability WG (2)

Following specs are embryonic

- WT-189: Energy Efficiency Test Plan: network equipment. Address concern that techniques may introduce network instabilities
- WT-190: Energy Efficiency Test Plan: end-user equipment. Based on joint requirements work with BBHome WG, and in collaboration with HGI and EU CoC
- WT-191: G.hn Test Plan
- PD-195: G.hn Test Cases for Interoperability Plugfest

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Architecture and Transport and IP/MPLS Core Working Groups

Evolving Network Architecture & Enhanced Speed Options critical to Next Phase of Broadband Success

A&T and IP/MPLS WG Multiservice Architecture / Industry issues

- Foundation for developing physical network architectures, network element specific requirements, defining QoS, Policy mgmt and Control (including security) in broadband multiservice networks (core, edge, CPE)
  - Impacts Layer 2 & 3 Systems/Software implementation requirements enabling common end-to-end Policy Management model, Call Admission Control (CAC) for BNG/BRAS, DSLAM and CP/Gateway network elements
- Conforming to IPv6 end-to-end architecture/systems/software requirements, defining migration steps to IPv6, interworking IPv4 & IPv6 communications
- Active Line Access (ALA) enabling Ethernet point-point GPON & EPON interconnect
- GPON and EPON:
  - Joint workshop with ITU-T SG 15 on development of conformance test suite and Plugfest to go beyond G.984 and OMCI messages which have been shown that GPON interoperability is not there yet to allow operators to source OLTs and ONUs from different vendors ?
  - TR-156, WT-167, TR-069 higher layer management, and G.984 interoperability key to GPON technology in large scale competitive markets. Interoperability requires standards from both organizations to be implemented.

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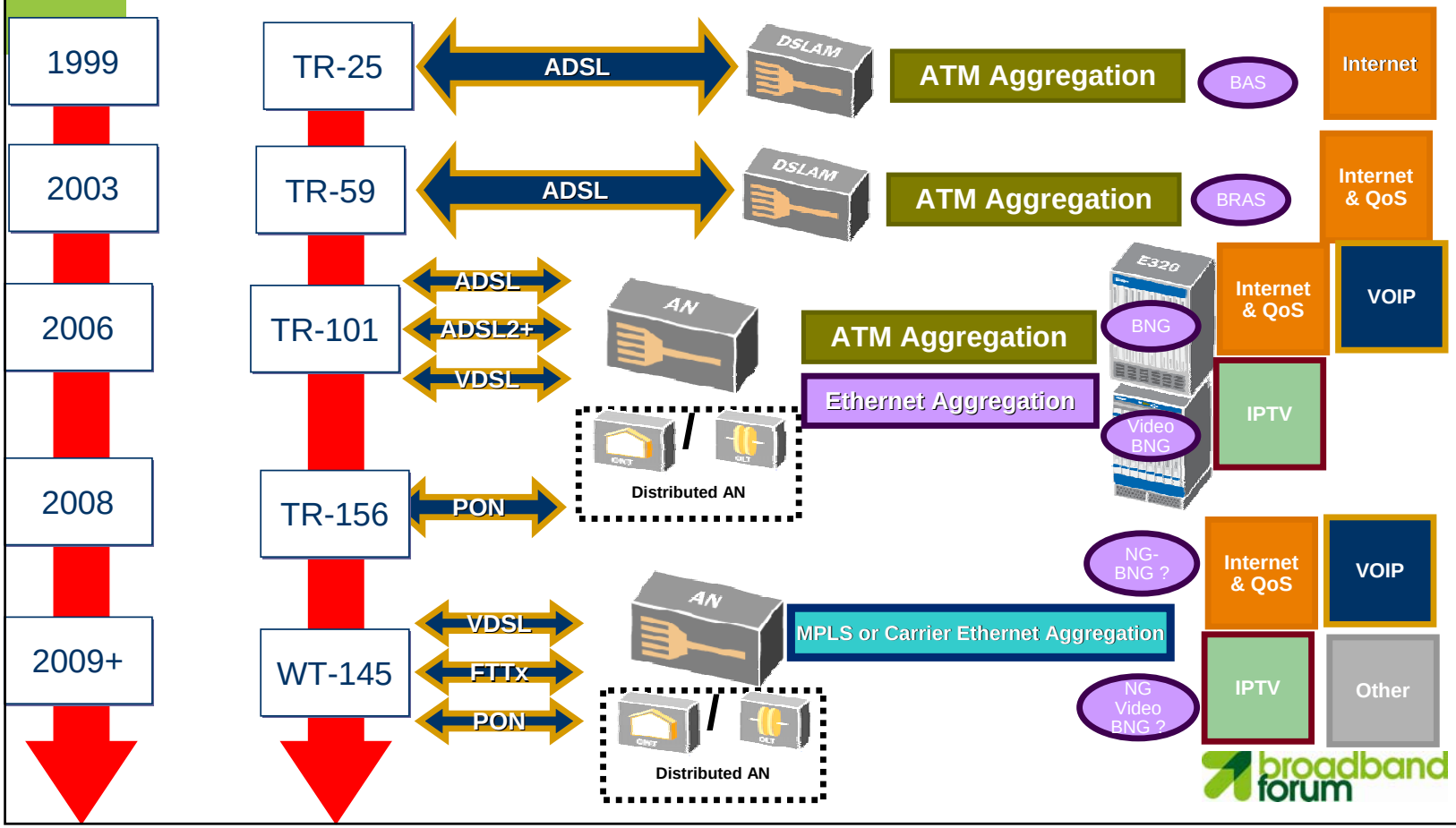
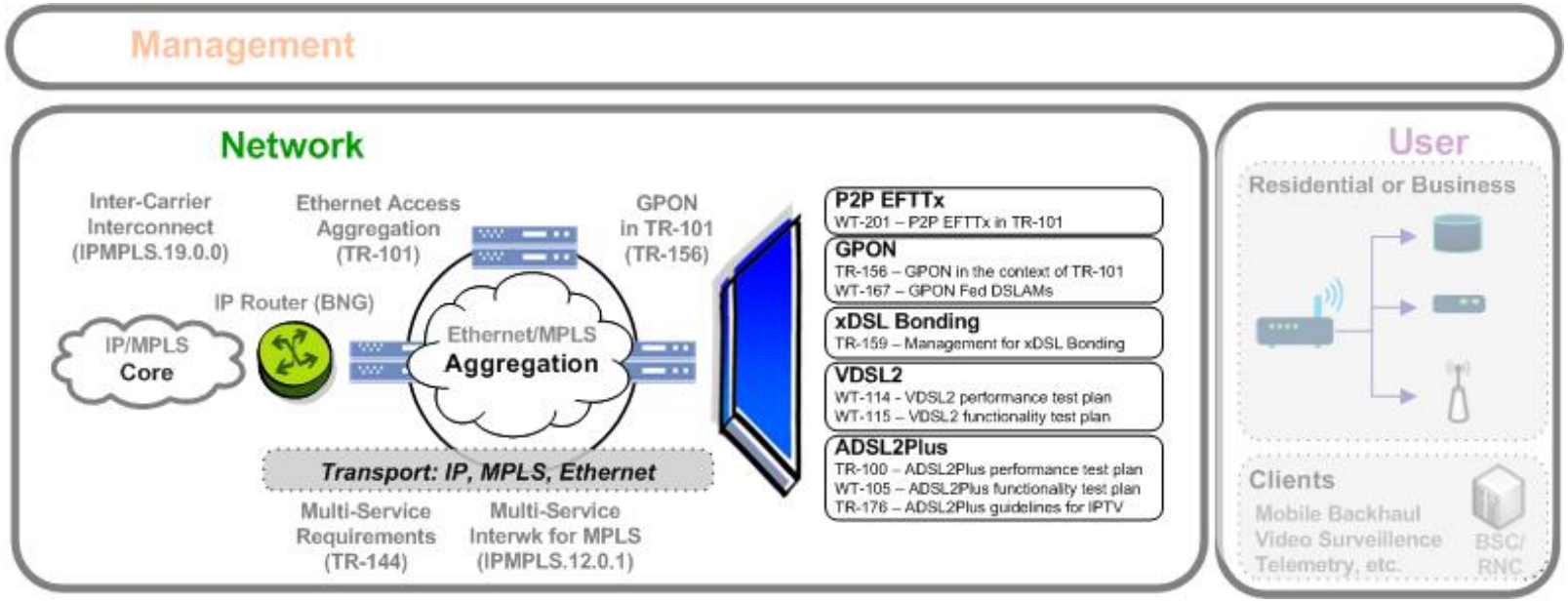
Network Architecture History/Roadmap

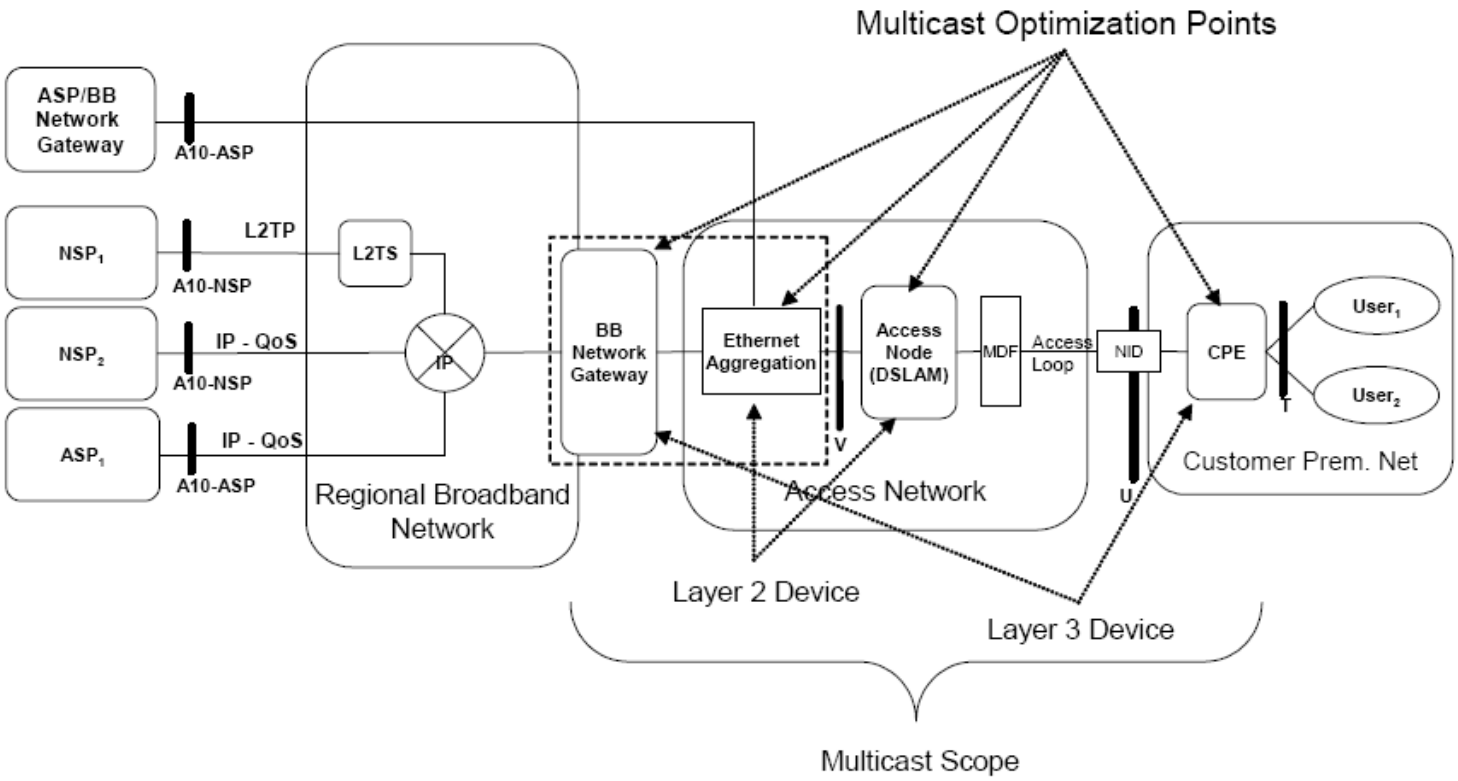


BroadbandNetwork

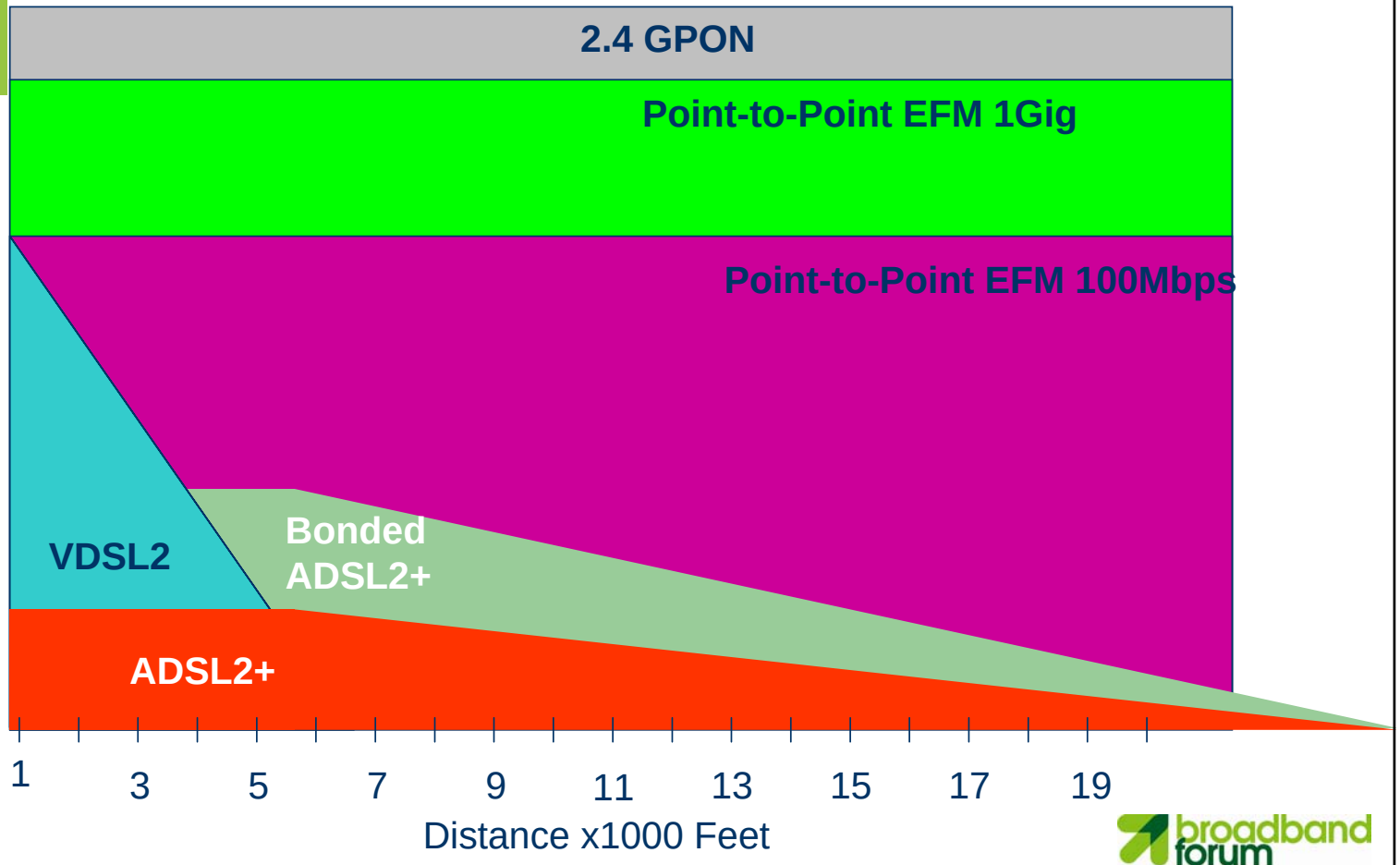


Broadband Network Architecture must be able to handle all types of access options

The 101 on TR-101



Fiber increases rate & reach options



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Architecture & Transport Working Group

- WT-167 : GPON-fed DSLAMs in straw ballot and comment resolution phase: Specifies GPON-fed Ethernet access node in TR-101 architecture supporting Remote Nodes, FTTB and FTTC deployments requiring ONUs having Ethernet switching functionality.
- WT-145 : TR-101*bis* (multi-protocol architecture)
- WT-134 : Policy Management Framework: Defining physical network architectures and element-specific requirements for policy management and control in Broadband multiservice networks
- TR-147 i2: Layer 2 real time control protocol between DSLAM and BRAS for coordination between network nodes in order to perform QoS -related, service-related, and subscriber-related operations
- WT-177 : IPv6 for TR-101
- WT-187 : IPv6 for PPP

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A & T Working Group

- WT-203 : Interworking between Next Gen Fixed Access and 3GPP Wireless. A Single SP offering both fixed and 3GPP wireless access and services.
- WT-178 : Nodal Requirements for WT-145
- WT-201 : Generic Requirements for Point-2-Point (P2P) Ethernet Access
- PD-200 : Generic Requirements for Shared Media Ethernet Access
- WT-146 : Basic notion of IP Subscriber Sessions, IP Flow classifiers, along with the IP session authentication and management supporting TR-101, WT-134 and WT-145
- WT-207 : TR-147 L2CP *bis:* extending L2C Mechanism (BNG/BRAS => Access Node) to include additional access technologies, new devices, and support new services.

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IP/MPLS & Core WG Activities

- **WT-221: Technical Specification for MPLS in Flat Mobile Networks**
  - Addresses reference location of mobile nodes (LTE/EPC) over fixed transport network.
  - Will include information on migration from 2G/3G to 4G architectures
  - Will include MEF service definition references
- **WT-222: Technical Specification for MPLS in Centralized Mobile Networks**
  - Usage of ATM N:1 cell mode where N>1
  - Addresses OAM mappings – need to include usage of OAM message mapping draft
  - Defaults when using RTP for TDM over MPLS
  - Addresses details on encapsulation and topologies (PW, IP, and pt-pt or mpt) used for packet distribution of clock (PW, NTP, etc). Need to resolve cell concatenation issue
- **WT-223: Requirements for MPLS over Aggregated Interfaces**
- **WT-224: MPLS in Carrier Ethernet Networks**
  - Liaise with MEF on work and use of MEF service definitions
- **WT-225: Abstract Test Suite for ATM Services over MPLS**
  - Certification program

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Broadband Forum Work Addresses Key Requirements for Wholesale Access & ALA

- **Functionality:**
  - QoS, security, multicast, flexible CPE & interconnect (as per ALA)
  - Management & diagnostics capabilities across the NNI to CPE
- **Integration:**
  - Leverage existing broadband platforms, systems & processes as much as possible (for both residential and business applications)
- **Standardization:**
  - Multiple entities will build Next Generation Access infrastructure in different geographies (localised infrastructure monopoly)
  - Commonality of network technology and architecture reduces integration costs for service providers to get national coverage
- **Differentiation:**
  - Need scope for differentiation & competition at retail level
  - Hence layer 2 Ethernet approach of ALA – transparent to IP layer
- **Future Proof:**
  - Be able to evolve to accommodate IPv6, WDM PON etc.

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Wholesale Challenges with TR-101/TR-156

- The ALA wholesale Ethernet access model uses stacked V-LANs
  - Achieves a direct mapping of the S-VLAN, C-VLAN pair to an access-line
- The Ethernet Wholesale services must use a specific S-VLAN tag that primarily relates to the Aggregation network egress point
- With the 1:1 VLAN model, an S-VLAN per Service Provider per Access Node is required which is a scaling challenge
- Other technologies can be used to segment the L2 domain
  - e.g. down to the most granular approach of a L2 domain per pair of Ethernet interfaces and associated tunnel or pseudo-wire
  - But, there remains a need for a VLAN allocation scheme
- Being discussed as part of WT-145 architecture work

Operations and Network Management

Emphasis: make it easier to configure and provision services, trouble reporting, diagnostics, and vectoring

Operations and Network Management WG – industry issues

- Reduced costs
- Reduced ‘stove piping’ of network technologies by generic management
- Essential for multi-vendor choices and for CPE retail market
- Customer self-install
- Will play role in energy efficiency
- Essential if vectoring performance benefits are to be realized

Operations & Network Mgmt WG

Service Assurance Focus

- PD-025 : Test & Diagnostics for Next Generation DSL Network
- WT-160 : IPTV Performance Monitoring & Diagnostics - Current Practice
- PD-161 : Remote Access Node Diagnostics
- PD-166 : Truncated Packet Interception for Performance Monitoring (a.k.a deep packet inspection like capabilities)
- PD-168 : IPTV Performance Monitoring & Diagnostics
- PD-180 : Extending IPTV Coverage
- PD-205 : GPON Management

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ONM WG

Element Management

- WT/TR-131: ACS Northbound Interface Requirements with BBHome
- WT-134: Policy Management Framework with AT WG
- WT-165 : Vector of Profiles: Greater flexibility in setting DSL & FTTx profiles by defining vector of profiles consisting of sets of config parameters i.e. PSD shaping, noise margins, INP, etc.
- WT-169 : EMS-NMS Functional Requirements for TR-101 Access Node
- WT-176 : ADSL2plus Profiles for IPTV. Work on VDSL2 profiles not started
- WT-188, WT-197 & WT-198 : DSL Quality Suite (DQS); DSL Quality Management (DQM) techniques ; Requirements for DQS ready system; respectively

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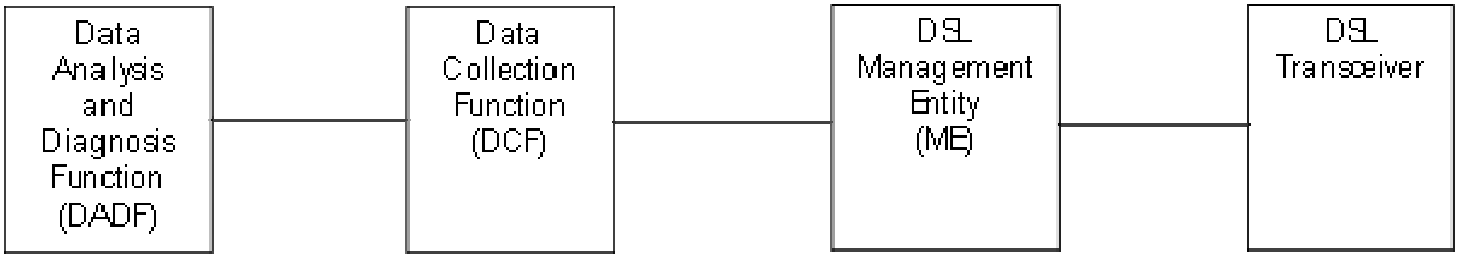
ONM WG

- The DQM system consists of the logical entities shown below:



- WT-198 Issues
  - Is Data Collection Function (DCF) centralized with DADF - will need to define DCF southbound (SB) interface; if DCF separate - will require SB and northbound (NB) interface requirements; if DCF integrated in NE (DSLAM) -require only NB interface. Which scenario?
  - What parameters (config, status, performances, scalar, vectorial, etc.), response times, … should be defined?
- If DCF centralized or distributed outside NE, is NB interface part of Network Element Management Interface?

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BroadbandHome WG – industry issues

- Improve customer experience across all managed devices: Home networking will not achieve its full potential until it is easy to install and maintain
- Reduced costs
- ‘Off the shelf’ CPE
- Home Gateway (HG) separates the delivery network from the home network and all content delivered to a subscriber
- Improving energy efficiency
- Enable service providers to provide/sell application software to end device
- Good deal of evolution is going to continue in this space – such as PON devices, Femtocell AP, PHY connectivity and retail CPE

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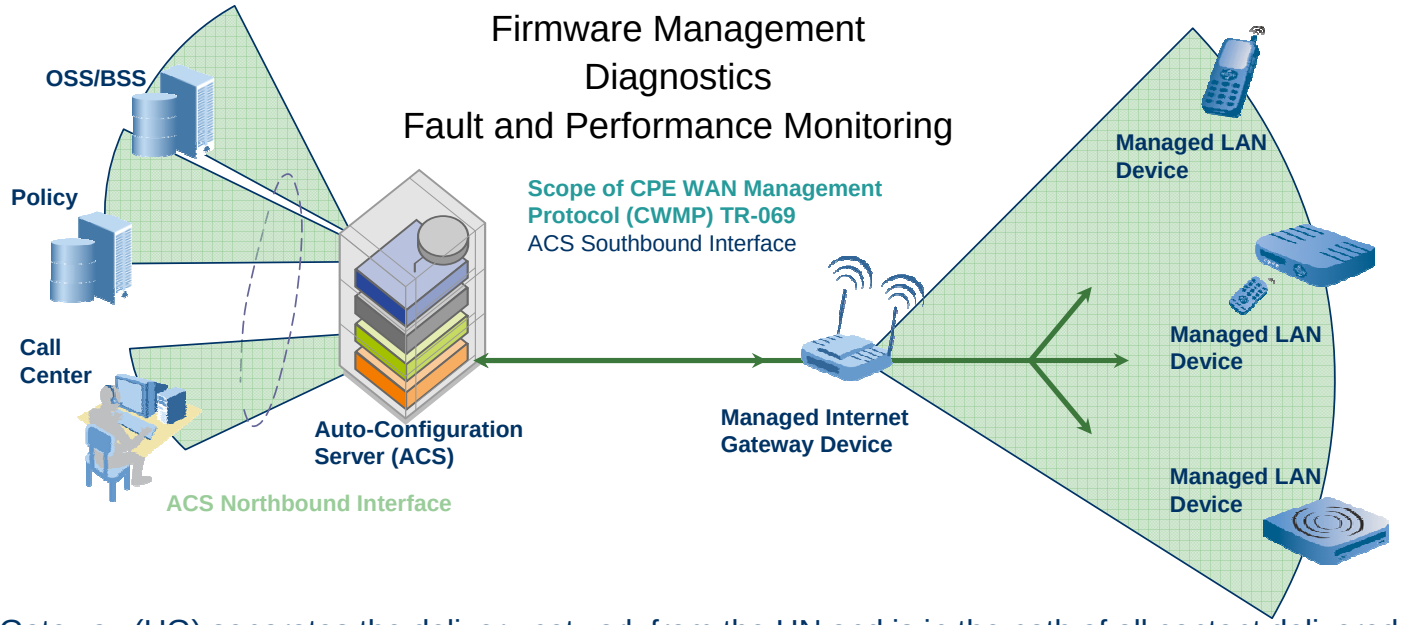
BroadbandHome Architectural Framework

Management Functions

Auto Configuration
Service Provisioning
Firmware Management
Diagnostics
Fault and Performance Monitoring



Home Gateway (HG) separates the delivery network from the HN and is in the path of all content delivered to a subscriber. The network does not have direct connection to the Home Network End Device (HNED) i.e. STB, ATA & VoIP device, WiFi Access Point, Femtocell Access Point, etc.

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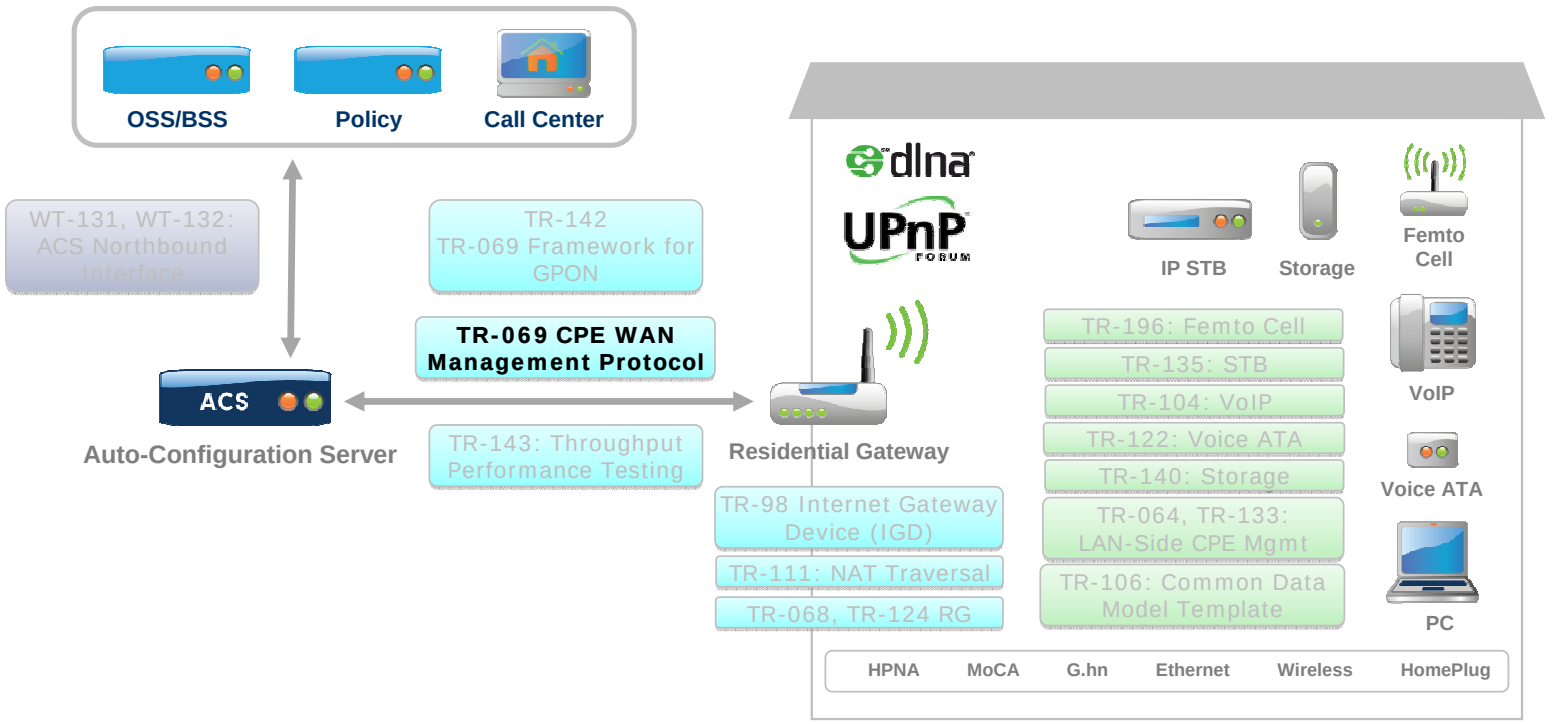
TR-069

Remote Management Framework

broadband suite™ management network user



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Organizations Referencing TR-069 et.al.

- Organizations referencing TR-069 and/or liaising/ collaborating on application of TR-069
  - ATIS IIF
  - DVB IPI
  - ETSI TS 183 065
  - Femto Forum
  - Home Gateway Initiative (HGI)
  - ITU-T HN / IPTV
  - Open IPTV Forum
  - WiMAX Forum
  - 3GPP RAN3
  - 3GPP SA5
  - 3GPP2
  - OSGi
  - UPnP

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Recent Completed Work (Cont)

- TR-196 -- Data model for Femto Access Points (FAPs)
  - Defined in conjunction with Femto Forum, 3GPP
  - Defines provisioning, diagnostic, and fault management parameters including radio (currently 3GPP 3G radio), GPS, IPSec, Femto auto-configuration, fault reporting
  - Work recently kicked off with 3GPP and 3GPP2 to define LTE and CDMA radio objects

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New Work Building on Customer WAN Management Protocol (TR-069)

- TR-106 Issue 2
  - PD-181: Gateway Management Model Re-Architecture (Interface Stack)
  - PD-157 High priority Interface Objects
- PD-194: Software Module Management
- PD -174: Management of non-TR-069 (“proxy”) devices
- IPv6 updates to TR-069 related TRs
- TR-069 Maintenance
  - Enhancements to TR-069 Protocol
  - Enhancements to published data models for VoIP, IPTV, etc.
- WT-131: ACS NBI requirements
- Bulk File Transfer Mechanisms
- TR-069 testing interop testing

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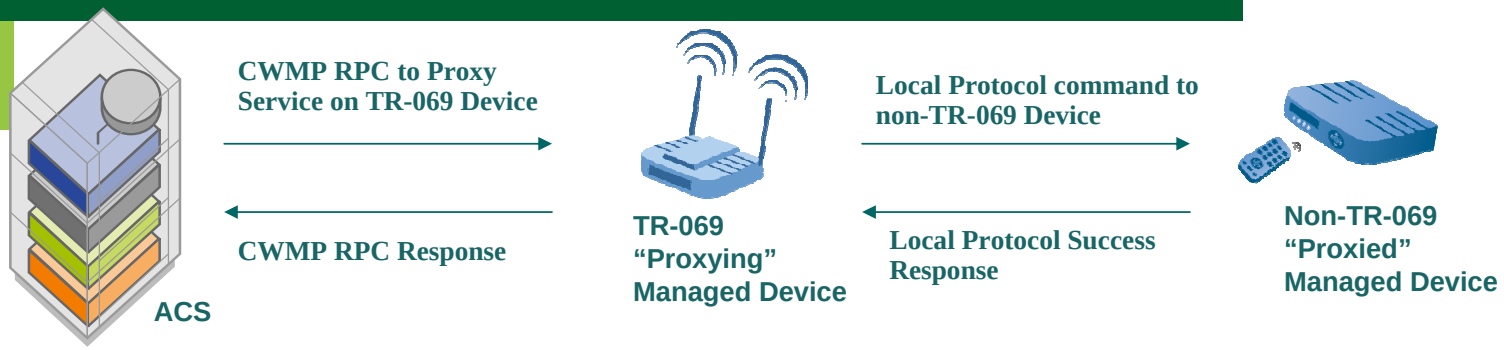
Applying TR-069 to the Home Network End Device: PD-174: Remote Management of non TR-069 Devices



- Proxy management agnostic to the local protocol
  - UPnP DM/DLNA
  - Layer 2 protocols (e.g. HomePlug OAM, etc.)
  - Home Automation protocols (e.g. Zigbee, Z-Wave, etc.)
  - Any proprietary local protocols known by the Proxying device
- TR-069 Proxying Device presents data model of local device as TR-069 managed objects
  - ACS sends management commands to proxying device
  - TR-069 Device converts TR-069 commands to local protocol
  - Once Proxied device has successfully executed commands, TR-069 device sends CWMP messages to ACS

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Focus for new work

- Maintenance of the protocol
- QoS
- GPON requirements
- IPv6 updates
- Energy efficiency
- Extending the set of data models
  - Proxy Management for retail CPE
  - Broadband Convergence

Working to Address Critical Needs

Current Focus of BBF EE Work

- Energy management in the home or small business
  - Building on TR-069, CPE WAN Management Protocol
  - Proxy management
- Implementation guidelines for low-power asymmetric digital subscriber line (ADSL2/ADSL2plus) L2 mode
- Energy test methodology and plans for
  - Network equipment
  - Customer premises equipment (CPE)
- Analyzing the Core – options for network consolidation
- Informative broadband white paper (MR-204)
  - Energy efficiency
  - Dematerialisation
- Collaboration with other SDOs on EE
- Energy impact statement now required for new TRs and WTs
- Will work with the EU JRC and HGI on BB CoC
- Work with HGI on the residential gateway energy efficiency requirements

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The BroadbandSuite Release Plan

The Release Plan is broken down into three major domains:

- BroadbandManagement
  - **Goal –** enhance network management capabilities and enable an intelligent, programmable control layer that unifies diverse networks
  - **Focus** - empower service providers to deliver and efficiently maintain personalized services that enhance the subscriber experience
- BroadbandNetwork
  - **Goal** - establish network architecture specifications to support current and emerging services and applications
  - **Focus** - deliver access, aggregation and core specifications that provide inherent interoperability, quality, scalability and resiliency capabilities from end-to-end
- BroadbandUser
  - **Goal** - Define unified networking standards by establishing a common set of CPE capabilities within the business, home and mobile environments
  - **Focus** - Simplify the service delivery process by developing common devices' identification, activation, configuration and maintenance specifications

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BroadbandSuite™ Release Plan Overview

- BroadbandSuite 1.0
  Internet access via ADSL or SHDSL over a QoS-enabled ATM architecture. Supports VoIP transport & VoDSL

- BroadbandSuite 2.0
  Triple-play access via ADSL2plus and SHDSL over a QoS-enabled Ethernet architecture. Full support for multicast to enable IPTV streaming

- BroadbandSuite 3.0
  Triple-play access augmented via GPON or bonded DSL over a QoS-enabled Ethernet architecture. Provides full support for multicast to enable IPTV streaming. Integrated remote management of Set-Top Box & storage devices

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What's next?
BroadbandSuite 3.1

MANAGEMENT R3.1	NETWORK R3.1	USER R3.1
TR-165 : Vector of Profiles	WT-114 : VDSL2 Performance Test plan	TR-157 Amendment 1: Supported Data Model Table
	WT-115 : VDSL2 Functionality Test Plan	TR-196: Femto Access Point Data Model
	TR-127 : Dynamic Testing of DSL Transceivers with Splitters	TR-106 Amendment 3: CWMP Data Model Schema (adding use cases)

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Benefits of BroadbandSuite 3.1

Management related specifications

- Defines a Vector of Profiles (VoP) based object model for DSL configuration that allows for great flexibility of configuration without an undue burden of data storage in DSL Element Managers or DSLAMs. This is particularly important for VDLS2+FTTx deployment scenarios
- Helps service providers implement efficient and cost effective network operation processes such as network creation, service delivery, service assurance and troubleshooting

Network related specifications

- Establishes an industry agreed test suite, ensuring common VDSL2 global standards- thereby expediting VDSL2 adoption, and helping manufacturing cost and ultimately price reductions
- Offers whole house splitter specifications that enhance IPTV delivery and ensure consistent customer satisfaction

User related specifications

- Extends TR-069 provisioning and maintenance to ensure quality Femto Access Point mobile service and coverage
- Provides the framework to continue building recognizable object models for emerging online devices- adding to the family of products and services easily managed via TR-069
- Establishes TR-069 use cases, expediting this management platform adoption

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Future Releases in the Pipeline

- Build on BroadbandSuite 3.0 with minor releases-
  - Multi-Play best practices
  - DSL Quality Management
- Next Major Release (BroadbandSuite 4.0) will establish network and CPE IPv6 transition specifications (2010)
- Future Releases expected to address-
  - Multi-service architecture based on TR-144 and anchored by work such as WT-145 and the MPLS in Mobile Backhaul Initiative (MMBI)
  - Energy efficient broadband
  - Fixed/Mobile Convergence
  - G.hn-based home networking

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Just Published!

Three new white papers

- BroadbandSuite 3.0 Companion Guide – guide to the use of 3.0 specifications
- Next Generation Broadband Access – guide to the application of NGA technologies
- Energy Efficiency and Dematerialization: Broadband Forum's Role

In Summary

- To expand the broadband footprint & support emerging applications, the Broadband Forum work empowers-
  - Fast & Responsive Networks
    - Evolving to packet based network
    - Addressing core-to-user network enhancements
  - Intelligent Remote Management
    - Forging a global remote management standard- TR-069
    - Works with all access platforms, and engineered for auto-configuration, maintenance and troubleshooting
    - Preparing for IPv6- ensuring the next 500M customers can be served!
  - Flexibility and tools to recognize and address the quality needs of all the new devices coming online
    - Real world solutions for home, business and mobile devices and applications

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In Summary, continued

- The BBF are happy to be able to assist the FCC National Broadband Plan Team with this critical project
- The BBF would draw the attention of the National BB Team to the very dynamic environment in the industry:
  - Rapid deployment of new fiber technologies
  - New developments improving the rate and reach of DSL
  - The changing bandwidth requirement for new services
  - New techniques to improve Quality of Experience to the consumer
  - New converged architectures uniting last mile technologies
  - Extension of the Broadband network into the home
- The BBF would encourage the National BB Team to recommend the use of industry recognized standards and specifications to speed up deployment times, improve service and reduce costs

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Questions?

Thank you for attending!

For more information:

www.broadband-forum.org